DAGSI Research Topic Template

1. **Research Title:** The advancement of machine learning tools for real-time mass spectral data processing for human performance monitoring

2. **Individual Sponsor:**

Dr. Sean W. Harshman, AFRL/RHBBA
Area B, Bldg. 840,
2510 Fifth Street
WPAFB, OH 45433
sean.harshman.1@us.af.mil

3. **Academic Area/Field and Education Level**

Computer science, Computational biology, or Related field (MS or PhD level)
Previous work with R or Python is strongly desired

4. **Objectives:** Advance established tools machine learning tools to 1) establish a comprehensive library of "normal" or baseline human breath profiles, 2) train the algorithm to recognize and filter out environmental contaminants, and 3) quantitatively measure the enhanced performance of the pattern recognition algorithm (accuracy, robustness, and predictive power).
5. **Description:** Thanks to its simple, on-demand collection, exhaled breath is a valuable tool for monitoring a wide range of physiological conditions and diseases. Historically, however, its application has been limited by the need for off-site laboratory analysis, creating a delay between when a sample is taken and when results are available. Newly developed real-time mass spectrometers provide instantaneous, on-site data, transitioning this laboratory technique from the lab to the field and enabling immediate decision-making right at the point of collection. While the raw data is easy to collect, the cumbersome analysis process is the critical bottleneck preventing this technology from reaching the warfighter. This project overcomes that barrier by advancing established predictive machine learning tools and polishing an intuitive graphical user interface (GUI). The goal is to translate complex biological data from human response to USAF stressors into immediate, actionable feedback. This directly supports the 711th HPW's core mission to optimize human performance, ensuring our Airmen and Guardians have the data they need to maintain peak readiness and mission effectiveness.
6. **Research Classification/Restrictions:** Unclassified/Unrestricted
7. **Eligible Research Institutions:** Any of the eighteen Ohio research universities are eligible to apply for a fellowship award.

NOTE: TOPIC IS PENDING STINFO APPROVAL. SUBMITTED 04Sep25.